

CLAIMS

1. A composite dielectric material comprising a resin material and an approximately spherical dielectric ceramic powder to be mixed with said resin material, the composite dielectric material being characterized in that:

 said dielectric ceramic powder is based on $\text{BaO}-\text{R}_2\text{O}_3-\text{TiO}_2$ (R: a rare earth element, R_2O_3 : an oxide of the rare earth element); and

 said dielectric ceramic powder comprises an oxide of a transition metal element having at least two states of ionic valences less than 4.

2. A composite dielectric material comprising a resin material and a dielectric ceramic powder to be mixed with said resin material, the composite dielectric material being characterized in that:

 said dielectric ceramic powder is based on $\text{BaO}-\text{R}_2\text{O}_3-\text{TiO}_2$ (R: a rare earth element, R_2O_3 : an oxide of the rare earth element) and the sphericity thereof is 0.8 to 1; and

 said dielectric ceramic powder comprises an oxide of a transition metal element having at least two states of ionic valences less than 4.

3. The composite dielectric material according to claim 1 or 2, characterized in that said transition metal element is Mn or Cr.

4. The composite dielectric material according to claim 1 or 2, characterized in that the sphericity of said dielectric ceramic powder is 0.85 to 1.

5. The composite dielectric material according to claim 1 or 2, characterized in that said dielectric ceramic powder has a composition that BaO: 6.67 to 21.67 mol%, R₂O₃: 6.67 to 26.67 mol%, and TiO₂: 61.66 to 76.66 mol%.

6. A composite dielectric material comprising a resin material and a dielectric ceramic powder to be mixed with said resin material, the composite dielectric material being characterized in that:

 said dielectric ceramic powder comprises one or more of a Mn oxide, a Cr oxide, a Fe oxide, a Co oxide, a Ni oxide and a Cu oxide, and has a specific surface area of 1.2 m²/g or less (exclusive of 0).

7. The composite dielectric material according to claim 6, characterized in that said dielectric ceramic powder comprises said Mn oxide and the content of said Mn oxide in said composite dielectric material is 0.12 wt% or less (exclusive of 0) in terms of MnO.

8. The composite dielectric material according to claim 6, characterized in that said dielectric ceramic powder comprises

said Mn oxide and the content of said Mn oxide in said composite dielectric material is 0.01 to 0.1 wt% in terms of MnO.

9. The composite dielectric material according to claim 6, characterized in that the sphericity of the particles of said dielectric ceramic powder is 0.8 to 1.

10. The composite dielectric material according to any one of claims 1, 2 and 6, characterized in that the mean particle size of said dielectric ceramic powder is 0.5 to 10 μm .

11. The composite dielectric material according to any one of claims 1, 2 and 6, characterized in that the dielectric constant ϵ thereof is 10 or more (measurement frequency: 2 GHz) and the Q value thereof is 300 or more (measurement frequency: 2 GHz).

12. The composite dielectric material according to any one of claims 1, 2 and 6, characterized in that the electric resistivity of said composite dielectric material is $1.0 \times 10^{12} \Omega\cdot\text{cm}$ or more.

13. The composite dielectric material according to any one of claims 1, 2 and 6, characterized in that the content of said dielectric ceramic powder is 40 vol% or more and 70 vol% or less when the total content of said resin material and said dielectric ceramic powder is represented as 100 vol%.

14. The composite dielectric material according to any one of claims 1, 2 and 6, characterized in that said resin material is a polyvinyl benzyl ether compound.

15. A substrate comprising a mixture composed of a resin material and a dielectric ceramic powder, the substrate being characterized in that:

 said dielectric ceramic powder is approximately spherical;

 the content of said dielectric ceramic powder is 40 vol% or more and 70 vol% or less when the total content of said resin material and said dielectric ceramic powder is represented as 100 vol%; and

 the electric resistivity of said substrate is 1.0×10^{12} $\Omega \cdot \text{cm}$ or more.

16. A substrate comprising a base having projections on the surface thereof and a composite dielectric material coating said base having said projections formed thereon, the substrate being characterized in that:

 said composite dielectric material comprises:

 a resin material; and

 a dielectric ceramic powder to be mixed with said resin material, the powder comprising a Mn oxide and being approximately spherical.

17. A substrate comprising a mixture composed of a resin material and a dielectric ceramic powder, the substrate being characterized in that:

the sphericity of said dielectric ceramic powder is 0.8 to 1;

the content of said dielectric ceramic powder is 40 vol% or more and 70 vol% or less when the total content of said resin material and said dielectric ceramic powder is represented as 100 vol%; and

the electric resistivity of said substrate is 1.0×10^{12} $\Omega \cdot \text{cm}$ or more.

18. A substrate comprising a base having projections on the surface thereof and a composite dielectric material coating said base having said projections formed thereon, the substrate being characterized in that:

said composite dielectric material comprises:

a resin material; and

a dielectric ceramic powder to be mixed with said resin material, the powder comprising a Mn oxide and the sphericity of the particles of the powder being 0.8 to 1.

19. The substrate according to any one of claims 15 to 18, characterized in that the dielectric constant ϵ thereof is 10 or more (measurement frequency: 2 GHz) and the Q value thereof is 300 or more (measurement frequency: 2 GHz).

20. The substrate according to any one of claims 15 to 18, characterized in that said substrate is used as electronic parts.